

WHAT IS CLAIMED IS:

1. A hearing aid analysis system comprising:

a source of prerecorded speech sounds;

5 hearing aid analysis circuitry, including:

circuitry to receive a plurality of signals representing signals generated by
speech sounds routed through different acoustic paths, and

filter circuitry to selectively simulate a hearing loss;

a hearing aid under test operably interfaced with the source of prerecorded speech

10 sounds and the hearing aid analysis circuitry; and

a computer system operably connected to the hearing aid analysis circuitry and
the source of prerecorded speech sounds, the computer system including:

a control program that operates to present the prerecorded speech sounds to
the hearing aid analysis circuitry to produce a first degraded signal routed through
15 the filter circuitry and a second processed signal routed through the hearing aid
and the filter circuitry; and

a speech recognition program that compares speech recognition from the first
degraded signal and speech recognition from the second processed signal to
determine an objective indication of speech perception enhancement for the
20 hearing aid under test.

2. The hearing aid analysis system of claim 1, wherein the control program operates to present the prerecorded speech sounds to produce a control unprocessed signal that is not routed through the filter circuitry or the hearing aid, the control unprocessed signal being used by the speech recognition program as a control for optimal speech recognition for the prerecorded speech sounds such that the objective indication of speech perception enhancement is expressed in relation to the control.

3. The hearing aid analysis system of claim 1, wherein the hearing aid analysis circuitry includes:

an analog to digital converter;
a digital to analog converter; and
a digital signal processor.

4. The hearing aid analysis system of claim 3, wherein the hearing aid analysis circuitry further includes programmable attenuators.

5. The hearing aid analysis system of claim 1, further comprising a multiple speaker arrangement operably connected to the hearing aid analysis system and acoustically coupled to the hearing aid under test such that the control program operates to present prerecorded speech sounds through different combinations of speakers in the multiple speaker arrangement to permit evaluation of directional microphone capabilities of the hearing aid under test.

6. The hearing aid analysis system of claim 5, wherein the multiple speaker arrangement is a 6.1 speaker complex sound field.

7. The hearing aid analysis system of claim 1, further comprising an outer ear acoustic
5 modification through which the prerecorded speech sounds are acoustically routed.

8. The hearing aid analysis system of claim 7, wherein the hearing aid is tested in position
in a user such that the outer ear acoustic modification is the physical structure of the user and the
hearing aid analysis circuitry further includes a probe tube microphone inserted in the ear canal
10 of the user.

9. The hearing aid analysis system of claim 1, wherein the filter circuitry selectively
simulates a hearing loss based on the latest physiology and psychoacoustic theory in order to
simulate the hearing loss suffered by a given patient.

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10. The hearing aid analysis system of claim 1, wherein the hearing aid analysis circuitry
further includes signal-to-noise analysis circuitry that estimates signal-to-noise ratio (SNR) of
the hearing aid under test to a plurality of different test signals under control of the computer
system and the computer system compares SNR for the plurality of test signals to provide an
20 additional objective determination of the benefit of the hearing aid under test.

11. The hearing aid analysis system of claim 10, wherein the hearing aid analysis circuitry further includes a test signal generator to generate the plurality of different test signals and the hearing aid analysis circuitry analyzes the different test signals routed through the hearing aid under test for a signal without phase cancellation or noise reduction, a phase cancellation only
5 signal, a noise reduction only signal and a combination of phase cancellation and noise reduction signals.

12. A method of testing the effectiveness of a hearing aid using a hearing aid analysis system, comprising the steps of:

10 interfacing the hearing aid under test with a source of prerecorded speech sounds and with hearing aid analysis circuitry including filter circuitry;

presenting the prerecorded speech sounds to the hearing aid analysis circuitry;

producing a first degraded signal routed through the filter circuitry;

15 producing a second processed signal routed through the hearing aid and the filter circuitry;

comparing speech recognition from the first degraded signal and speech recognition from the second processed signal using a speech recognition program; and

determining an objective indication of speech perception enhancement for the hearing aid under test.

20 13. The method of claim 12, further comprising:

presenting the prerecorded speech sounds to produce a control unprocessed signal that is not routed through the filter circuitry or the hearing aid; and

using the control unprocessed signal in the speech recognition program as a control for optimal speech recognition for the prerecorded speech sounds such that the objective indication of speech perception enhancement is expressed in relation to the control.

14. The method of claim 12, further comprising:

connecting a multiple speaker arrangement to the hearing aid analysis system and acoustically coupling the multiple speaker arrangement to the hearing aid under test;

presenting prerecorded speech sounds through different combinations of speakers in the multiple speaker arrangement; and

evaluating directional microphone capabilities of the hearing aid under test.

15. The method of claim 14, wherein the step of connecting a multiple speaker arrangement to the hearing aid analysis system further comprises connecting a 6.1 speaker complex sound field to the hearing aid analysis system and acoustically coupling the 6.1 speaker complex sound field to the hearing aid under test.

16. The method of claim 12, further comprising:

acoustically routing the prerecorded speech sounds through an outer ear acoustic modification.

17. The method of claim 16, further comprising:

inserting a probe tube microphone into the ear canal of a user; and

testing the hearing aid in position in the user such that the outer ear acoustic modification is the physical structure of the user.

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18. The method of claim 12, further comprising:

selectively simulating a hearing loss based on the latest physiology and psychoacoustic theory in the filter circuitry to simulate the hearing loss suffered by a given patient.

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19. The method of claim 12, further comprising:

estimating a signal-to-noise ratio (SNR) of the hearing aid under test to a plurality of different test signals; and

comparing the SNR for the plurality of test signals to provide an additional objective determination of the benefit of the hearing aid under test.

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20. The method of claim 19, further comprising:

generating a plurality of different test signals using a test signal generator; and

analyzing the different test signals routed through the hearing aid under test for a signal without phase cancellation or noise reduction, a phase cancellation only signal, a noise reduction only signal, and a combination of phase cancellation and noise reduction signals.

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